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BAKER (MICHAEL) JR INC BEAVER PA
NATIONAL DAM SAFETY PROGRAM. POTOMAC RIVER BASIN. COVE NUMBER 2--ETC(U)
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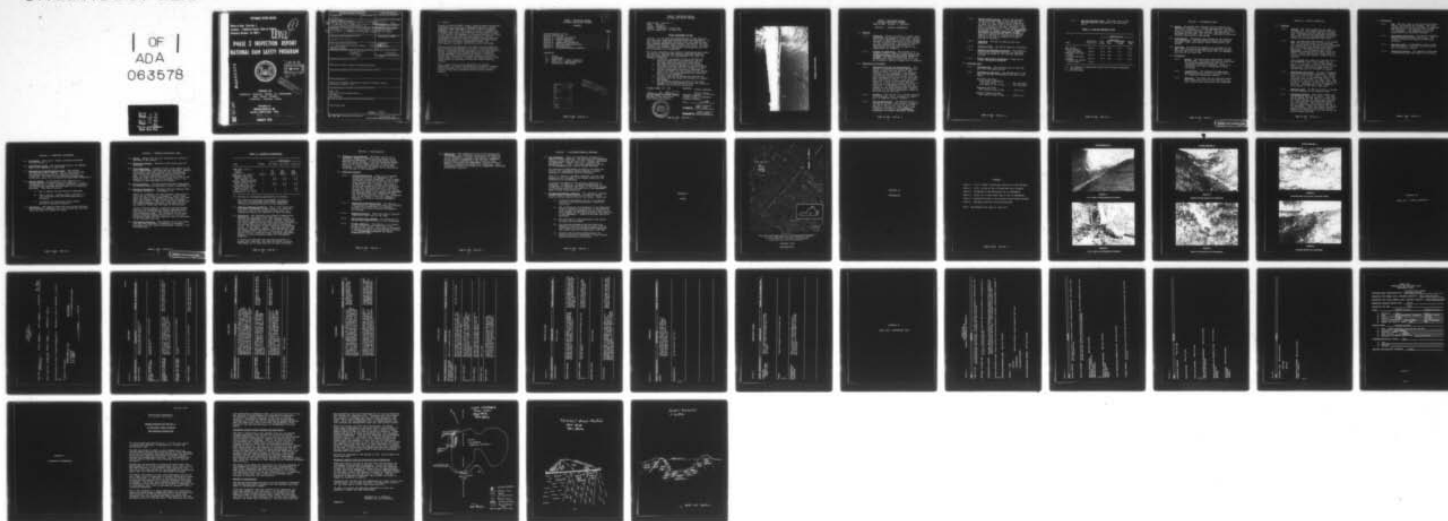
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POTOMAC RIVER BASIN

Name of Dam: Cove No. 2

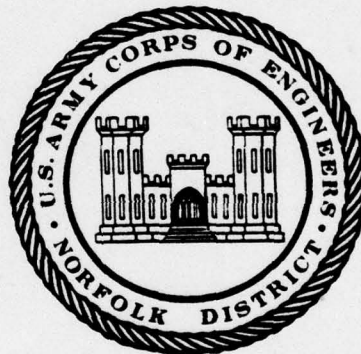
Location: Frederick County, State of Virginia

Inventory Number: VA 06911

LEVEL

PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

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PREPARED FOR
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

PREPARED BY
MICHAEL BAKER, JR., INC.
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AUGUST 1978

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.



(1)

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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NAME OF DAM: COVE NO. 2

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Cove No. 2
State: Virginia
County: Frederick
Stream: Tributary to Laurel Run
Date of Inspection: 16 June 1978

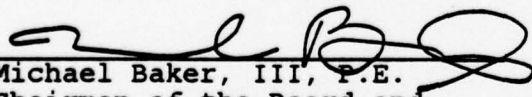
BRIEF ASSESSMENT OF DAM

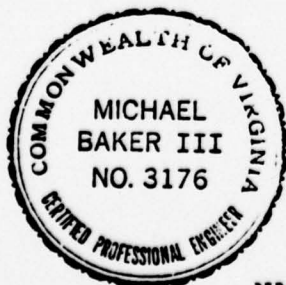
Cove No. 2 is an earth dam approximately 38 feet high and 500 feet long, owned and operated by the Cove Operators. It has a natural topographic spillway that will pass the one-half Probable Maximum Flood; however, the dam will be overtopped by the Probable Maximum Flood by 0.2 foot. No slope failures were observed, but further investigation and stability analyses are recommended.

The visual inspections and review of engineering data, made in June 1978, indicate deficiencies requiring attention. The following measures are recommended to the owner for immediate attention:

- 1) A detailed topographic survey of the dam and spillway areas should be conducted, and the spillway capacities should be reevaluated.
- 2) The camping areas downstream of the spillway should be relocated, because the spillway may be activated with less than five inches of runoff.
- 3) Further investigation should be conducted to assess the effect of clear seepage at the embankment toe on the piping potential and slope stability of the embankment.
- 4) The bare areas on the downstream slope of the emergency spillway should be covered with topsoil and seeded.
- 5) The excavated emergency spillway at the right abutment of the dam should be lined with riprap or another form of erosion protection.

MICHAEL BAKER, JR., INC.


Michael Baker, III, P.E.
Chairman of the Board and
Chief Executive Officer



APPROVED: Original signed by:

Douglas L. Haller

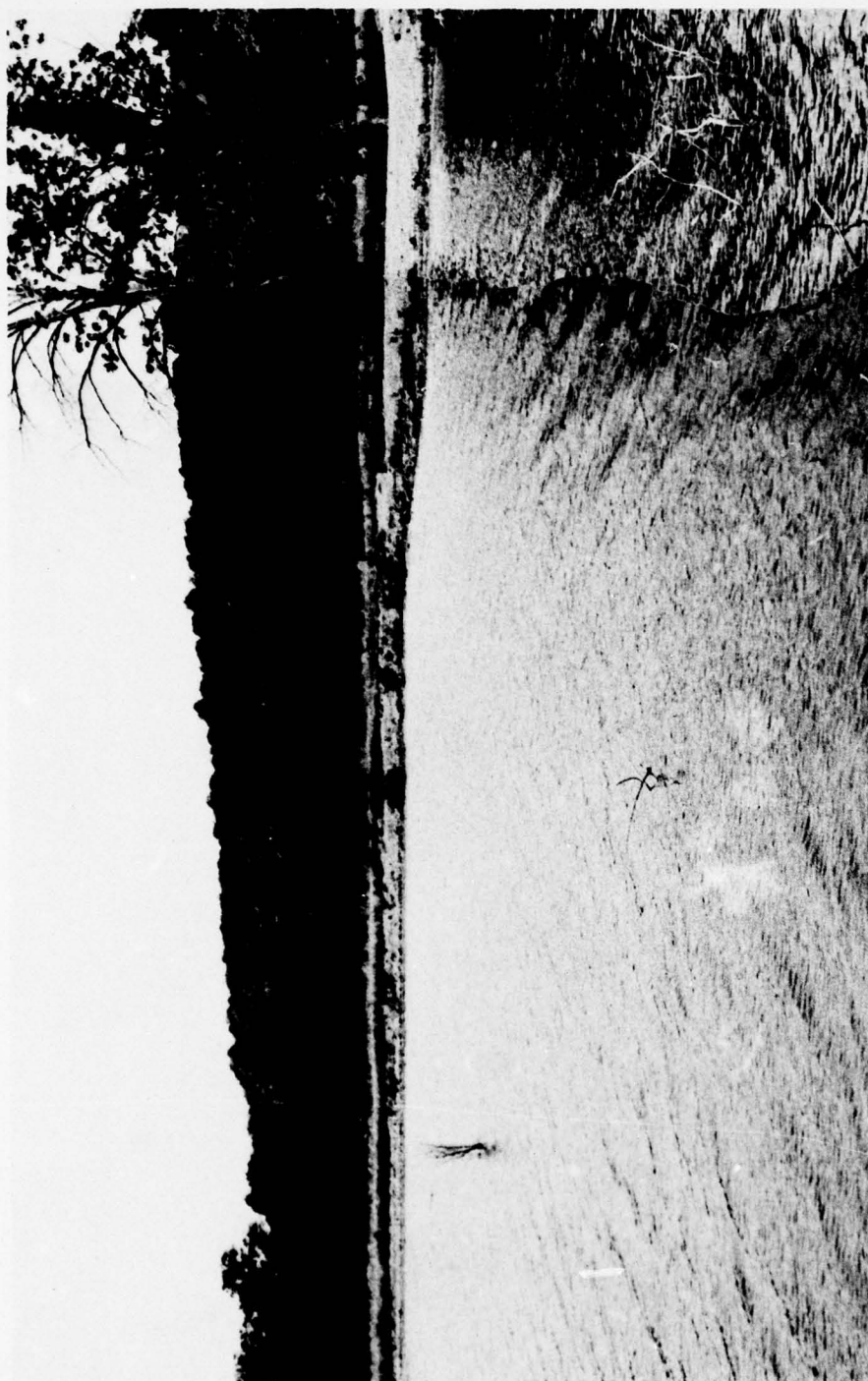
Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: 31 AUG 1978

Submitted By: Original signed by
JAMES A. WALSH

Recommended By: Original signed by
ZANE M. GOODWIN

NAME OF DAM: COVE NO. 2



OVERALL VIEW OF DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: COVE NO. 2 ID# 06911

SECTION 1 - PROJECT INFORMATION

1.1 General

- 1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.
- 1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

- 1.2.1 Description of Dam and Appurtenances: Cove Dam No. 2 consists of an earth dam approximately 38 feet high and 500 feet long. Seepage control is provided by an upstream clay zone in the embankment. The primary spillway and outlet works consist of an 18 inch corrugated metal pipe at the left abutment (see Photos 1 and 2). A 10 inch steel pipe with a valve on the downstream end serves as a drain for the lake (see Photo 4). There are two emergency spillways for the reservoir: an excavated 12 feet wide earth channel on the right abutment and a natural spillway via the diked topographic saddle on the left side of the lake.
- 1.2.2 Location: Cove Dam No. 2 is located upstream of Cove Dam No. 1 on a tributary to Laurel Run, in Frederick County, Virginia.
- 1.2.3 Size Classification: The maximum height of the dam is 38 feet. The reservoir volume to the top of dam is less than 225 acre-feet. Therefore, the dam is in the "small" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

NAME OF DAM: COVE NO. 2

- 1.2.4 Hazard Classification: Due to the proximity of the girl scout camp at Enon Springs and the Town of Gore, Virginia with a population of about 150, many lives could be lost in the event of failure of the dam. Therefore, this dam is considered in the "high" hazard category as defined by Section 2.1.2 of the Recommended Guidelines for Safety Inspection of Dams. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failures.
- 1.2.5 Ownership: The dam is owned by the Cove Operators.
- 1.2.6 Purpose of Dam: The dam is used for recreation.
- 1.2.7 Design and Construction History: The existing facility was designed and built by the owner. Construction began in 1973 and was completed in 1974.
- 1.2.8 Normal Operational Procedures: There are no formal operating procedures.

1.3 Pertinent Data

- 1.3.1 Drainage Area: The drainage area of Cove Dam No. 2 is 0.63 square miles.
- 1.3.2 Discharge at Dam Site: The maximum flow at the dam site through the emergency spillway is not known.

Principal Spillway:

Pool level at emergency
spillway crest Not Available
Pool level at top of dam Not Available

Emergency Spillway:

Pool level at top of dam 139 c.f.s.

Natural Saddle Spillway:

Pool level at top of dam 2000 c.f.s.

NAME OF DAM: COVE NO. 2

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet M.S.L.	Area acres	Reservoir(a)		Length feet
			Capacity		
			Acre- feet	Watershed inches	
Top of dam	1210.9	21.4	225	6.7	N.A.
Natural saddle spillway crest	1209.2	20.0	190	5.7	N.A.
Emergency spillway crest	1207.9	19.0	163	4.9	N.A.
Principal spillway crest	1207.2	18.5	149	4.4	N.A.
Streambed at center- line of dam	1172.9	-	-	-	-

(a) All values are approximate based upon limited topographic information.
N.A.-Not Available

NAME OF DAM: COVE NO. 2

SECTION 2 - ENGINEERING DATA

- 2.1 Design: The design data reviewed was the Construction Memorandum (Appendix V). Design considerations included: use of an old existing dam, a natural spillway, dam zoning, internal drainage, and local geology. The design was performed by the owner, who is not a registered professional engineer experienced in dam design.
- 2.2 Construction: Information was provided by the Construction Memorandum. The memorandum describes construction equipment, pipe installation, drain construction, and zoning.
- 2.3 Operation: No history of operation is recorded for the dam. The Construction Memorandum discusses the primary spillway and outlet works, and states that the emergency spillway has not been used.
- 2.4 Evaluation
- 2.4.1 Design: The Construction Memorandum, written by the owner, was helpful but can not substitute for plans and specifications done by an independent registered engineer. There is no indication of a site or topographic survey for design.
- 2.4.2 Construction: The Construction Memorandum should not replace as-built drawings done by an independent registered engineer.
- 2.4.3 Operation: The owner did not indicate whether the 10 inch gate valve on the lake drain has been checked since construction was completed.

NAME OF DAM: COVE NO. 2

SECTION 3 - VISUAL INSPECTION

3.1 Findings

- 3.1.1 General: The field inspection was made on 16 June 1978. No unusual weather conditions were experienced and the lake was at normal pool. The dam and the appurtenant structures were found to be in good physical condition except for the deficiencies noted below.
- 3.1.2 Dam: The upstream slope appears to be steeper than the three horizontal to one vertical (3:1) value shown in the Construction Memorandum. The downstream slope appears to be equal to the 1.5:1 value shown in the Construction Memorandum. The downstream face of the embankment has many areas without vegetative cover. Vehicle traffic has caused ruts on the top of the dam; however, erosion was not apparent.
- Clear seepage was found all along the toe of the embankment with flows ranging from 0.5 g.p.m. to 3.0 g.p.m. Some of the seepage water is reddish-brown colored due to an iron precipitate. These clear seeps should be checked regularly for evidence of piping.
- 3.1.3 Appurtenant Structures: The small emergency spillway has no erosion protection. However, there is a twelve feet wide by two to three feet high fill at the southwest edge of the reservoir which serves as a small dike. The elevation at the top of this dike, which also serves as a roadway, is about the same as the spillway. Non-measurable clear seepage is also present at the toe of this fill.
- 3.1.4 Reservoir Area: No serious erosion or sloughing was observed in the reservoir area.
- 3.1.5 Downstream Channel: The outlet channel for the emergency spillway is narrow. The downstream channel for the dike is a grassy area. The outlet channel for the primary spillway is a waterfall down the steep rock ridge of the left abutment. The waterfall empties into a stream located just behind the toe of the embankment. There are several buildings used for storage and office space located immediately downstream of the dike across the natural saddle spillway.

NAME OF DAM: COVE NO. 2

3.2 Evaluation

- 3.2.1 Dam: The bare areas on the dam should receive topsoil and possibly be reseeded. The clear seepage should be further assessed to determine the elevation of the phreatic line through the embankment. The embankment crest and slopes should be accurately surveyed.
- 3.2.2 Appurtenant Structures: The smaller emergency spillway should be lined with riprap. The natural spillway area should be accurately surveyed.
- 3.2.3 Reservoir Area: A topographic survey around the lake should be done for accurate measurement of reservoir storage.
- 3.2.4 Downstream Channel: The campsites downstream of the natural spillway should be relocated.

NAME OF DAM: COVE NO. 2

SECTION 4 - OPERATIONAL PROCEDURES

- 4.1 Procedures: There are no formal operating procedures for Cove Dam No. 2.
- 4.2 Maintenance of Dam: The downstream slope of the embankment is not vegetated in some areas.
- 4.3 Maintenance of Operating Facilities: The primary spillway was clear of debris. The 10 inch outlet pipe and downstream valve were not operated during the inspection. The owner did not describe the operation of the gate valve in his Construction Memorandum (Appendix V).
- 4.4 Warning System: At the present time, there is no warning system or evacuation plan in operation. It is recommended that a formal emergency procedure be prepared and prominently displayed and furnished to all operating personnel. This should include:
- 1) How to operate the dam during an emergency.
 - 2) Who to notify, including public officials, in case evacuation from the downstream area is necessary.
 - 3) Procedures for evaluating inflow during periods of emergency operation.
- 4.5 Evaluation: The camping areas below the natural spillway may be flooded frequently since the spillway may activate with less than five inches of runoff.

SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

- 5.1 Design: Design data were not available for review at the time of this report.
- 5.2 Hydrologic Records: Records of lake levels were not available.
- 5.3 Flood Experience: Evidence of past flood damage to the dam or appurtenant structures was not observed. Observations made in the field indicate that the emergency spillway has been activated at various times in the past. A natural topographic saddle with a two to three feet high dike is located on the left side of the reservoir with a low point at elevation 1209.2. No evidence of dike overtopping was visible.
- 5.4 Flood Potential: Spillway capacities were established by routing various hydrographs as noted in paragraph 5.6.
- 5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1, paragraph 1.3.3.

Except for withdrawal for lake drainage, regulation of flow from the reservoir is automatic. Water rising above the crest of the primary spillway flows into this inlet and through the dam in the 18 inch corrugated metal pipe conduit. Water also flows past the dam over the ungated emergency spillway in the event water in the reservoir rises over the crest of the spillway.

Outlet discharge capacity, reservoir area and storage capacity, and hydrograph and routing determinations were based on a limited site survey and U.S.G.S. 7.5 minute quadrangle maps. The routing of the 100 year, one-half Probable Maximum Flood (P.M.F.), and P.M.F. hydrographs began with the reservoir level at the crest of the principal spillway.

- 5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on reservoir performance for the various hydrographs is shown in the following table:

NAME OF DAM: COVE NO. 2

TABLE 5.1 RESERVOIR PERFORMANCE

Item	Normal	Hydrograph		
		100 Year	1/2 P.M.F.	P.M.F.(a)
Peak flow, c.f.s.				
Inflow	-	610	1321	2642
Outflow	-	51	1258	2642
Peak el., ft., M.S.L.	1207.2	1209.3	1210.5	1211.1
Emergency spillway				
Depth of flow, ft.	-	1.4	2.6	3.2
Avg. velocity, f.p.s.	-	2.5	4.1	4.7
Natural saddle spillway				
Depth of flow, ft.	-	0.1	1.3	1.3
Avg. velocity, f.p.s.	-	0.6	4.3	5.0
Non-overflow section				
Depth of flow, ft.	-	-	-	0.2
Avg. velocity, f.p.s.	-	-	-	1.1
Tailwater el., ft. M.S.L.	-	-	-	-

(a) Duration of overtopping approximately 40 minutes.

The reservoir performance hydrographs outlined in Table 5.1 were developed from limited topographic information obtained during the field inspection.

- 5.7 Reservoir Emptying Potential: The 10 inch outlet pipe will permit withdrawal of about nine c.f.s. with the reservoir level at the primary spillway crest and essentially dewater the reservoir in about two weeks.
- 5.8 Evaluation: The hydrologic and hydraulic computations prepared for this report show that the P.M.F. will overtop the embankment by 0.2 foot assuming the dike in the natural saddle does not erode. However, based upon the field inspection and the velocities noted in Table 5.1, the earthen dike could erode away before overtopping occurs. An evaluation of this erosion was not included as part of this Phase I report. Although hydraulic and hydrologic computations indicate that the dam will pass the one-half P.M.F. and P.M.F. with erosion, the owner should initiate a detailed study, including topographic mapping, to more accurately assess the overtopping potential.

It should be indicated that conclusions pertain to present day conditions, and that the effect of future development on the hydrology has not been considered.

NAME OF DAM: COVE NO. 2

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: The owner, who is not a geologist, prepared a report on site geology in the Construction Memorandum. Although the report mainly described areal geology, it also described the foundation for the dam as "dense red clay, 40 feet thick." There are no test borings available to verify this thickness. In addition, the report has no description of the geology of the abutments.

6.2 Stability Analysis

- 6.2.1 Visual Observations: There is no sloughing or slope failure in the embankment, cut slopes and drainage structures. Clear seepage was observed along the downstream toe of the slope ranging from 0.5 g.p.m. to 3.0 g.p.m. as measured at four locations (see Photo 3). Springs were reported in the shale foundation of the dam, during construction. The clear seepage from the shale fill at the toe of the dam does not appear to be eroding the embankment. The abutments have clear seepage upwelling near the downstream toe of the fill. Determination of the source of the clear seepage is desirable to properly evaluate embankment stability.
- 6.2.2 Design and Construction Data: No stability calculations or construction plans are available. A Construction Memorandum with schematic drawings and geologic sections was supplied by the owner.
- 6.2.3 Operating Records: There have been no periodic inspections other than by the owner.
- 6.2.4 Post-Construction Changes: No alterations of the dam were reported since it was constructed.
- 6.2.5 Seismic Stability: Cove Dam No. 2 is located in the vicinity of the demarcation line between Seismic Zones 1 and 2 and is considered to present no hazard from earthquakes according to the Recommended Guidelines for Safety Inspections of Dams.

NAME OF DAM: COVE NO. 2

- 6.3 Evaluation: The information given in the Construction Memorandum is not sufficient to evaluate the stability of the embankment. Further investigation is needed to obtain: as-built embankment cross sections, embankment and foundation strength data, the location of the phreatic line within the embankment, and the factors of safety for drawdown and steady state conditions. This information should be provided by an independent registered professional engineer.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

- 7.1 Dam Assessment: There are detrimental findings as a result of this inspection. The spillways are considered adequate to pass the one-half P.M.F. without overtopping the embankment. However, the P.M.F. overtops the embankment by 0.2 foot. The clear seepage at the toe of the embankment must also be further assessed.

The Construction Memorandum provided by the owner was helpful; but independent design drawings, as-built drawings or calculations were not available.

There is no need for emergency measures, but the clear seepage at the toe needs to be studied further by the installation of piezometers.

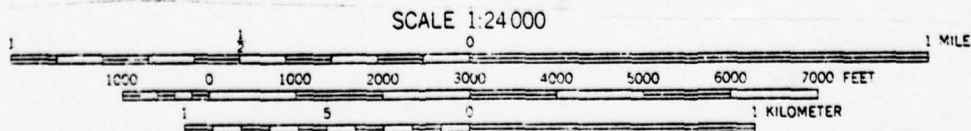
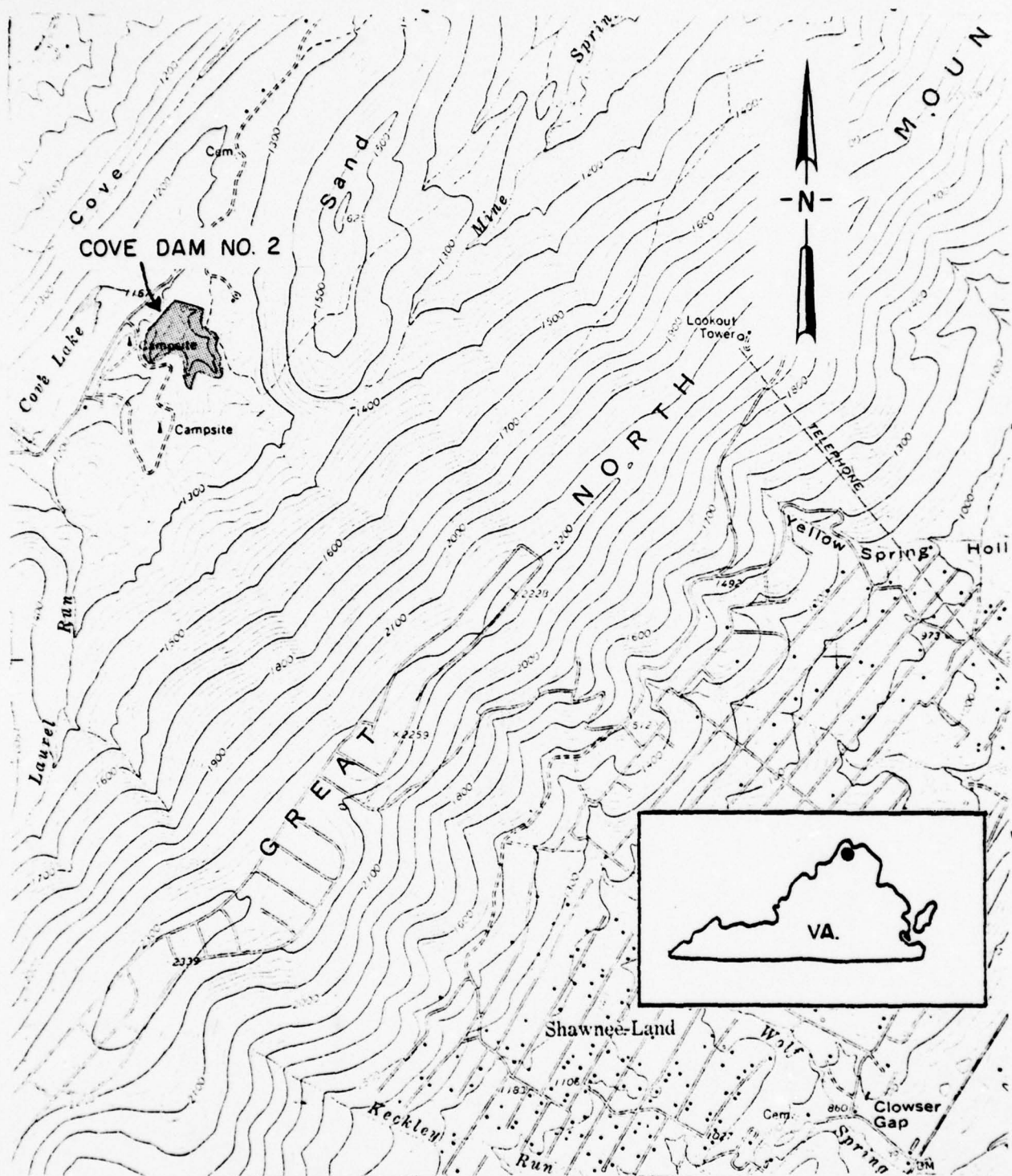
A detailed assessment of the spillway capacities is necessary. In addition, a limited investigation is recommended to determine the effect of the clear seepage on the piping potential and stability of the embankment under various flood conditions.

- 7.2 Recommended/Redmedial Measures: The inspection revealed certain items of rehabilitation or other work which should be given high priority by the owners. These are:

- 1) A detailed topographic survey of the dam and spillway areas and reevaluation of spillway capacities.
- 2) The installation of piezometers in the downstream slope to determine the elevation of the phreatic line through the embankment and the effect of the clear seepage on the piping potential and stability of the embankment. Stability analyses should be performed.
- 3) The bare areas on the downstream slope should be topsoiled and seeded.
- 4) The excavated emergency spillway should be seeded or lined with riprap to resist erosion from greater flows than experienced during the four years since the construction of the dam.
- 5) Relocate the buildings downstream of the natural spillway or institute a formal warning system during severe rainstorms.

APPENDIX I

PLATES



LOCATION PLAN
COVE DAM NO. 2

APPENDIX II

PHOTOGRAPHS

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- Photo 1: C.M.P. Intake of Principal Spillway at Left Abutment
- Photo 2: C.M.P. Outlet on Top of Ridge Near Left Abutment
- Photo 3: Streamflow Along Downstream Toe of Embankment
- Photo 4: Outlet of 10 Inch Steel Pipe at Toe of Embankment
- Photo 5: Downstream Slope of Dam Looking Toward Right Abutment
- Photo 6: Emergency Spillway Looking Downstream

Note: Photographs were taken 16 June 1978.

NAME OF DAM: COVE NO. 2

COVE DAM NO. 2



PHOTO 1

C. M. P. Intake of Principal Spillway at Left Abutment



PHOTO 2

C. M. P. Outlet on Top of Ridge Near Left Abutment

COVE DAM NO. 2



PHOTO 3

Streamflow Along Downstream Toe of Embankment



PHOTO 4

Outlet of 10 Inch Steel Pipe at Toe of Embankment

COVE DAM NO. 2



PHOTO 5

Downstream Slope of Dam Looking Toward Right Abutment



PHOTO 6

Emergency Spillway Looking Downstream

APPENDIX III

CHECK LIST - VISUAL INSPECTION

Check List
Visual Inspection
Phase 1

Name Dam Cove No. 2 County Frederick State Virginia Coordinates Lat. 3913.3
(Lake Leckszas) Long. 7822.0

Date Inspection 16 June 1978 Weather Cloudy Temperature 75° F.

Pool Elevation at Time of Inspection 1207.2 M.S.L. Tailwater at Time of Inspection -- M.S.L.

HH-1

Inspection Personnel:

MICHAEL BAKER, JR., INC.:

D. J. Greenwood
J. M. Thompson
W. L. Sheaffer

COVE OPERATORS:

A. W. K. McDowell (Partial Owner)

D. J. Greenwood Recorder

EMBANKMENT

Cove No. 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	There were no significant surface cracks visible during the field inspection.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE H H H - 2	No unusual movement or cracking was visible beyond the toe.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Sloughing of the embankment or abutment slope was not visible. The vegetative cover on the dam is variable with bare areas covered by shale fragments. Erosion is minor. The abutment slopes do not appear to be eroded.	Additional vegetative growth would be hard to foster on the shale slopes.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The vertical and horizontal crest alignment is good.	
RIPRAP FAILURES	Riprap was not used in construction.	Riprap should be placed on the upstream face if wave erosion develops.

EMBANKMENT

Cove No. 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONSTRUCTION MATERIAL	<p>According to the Construction Memorandum, the dam was constructed in three zones (clay, fine shale and coarse shale) as shown on the owner's cross section. The clay zone covers an old 12 feet high S.C.S. clay dam upstream. Brown, silty clay with shale fragments was observed on the upstream side and shale fragments with a little clayey silt on the downstream slope. The soil and shale were compacted by a loaded scraper and crawler tractor.</p>	
<p>JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM</p> <p>HH HH H J</p>	<p>The right abutment is in hard shale and sandstone as exposed in the emergency spillway. The left abutment is keyed into a ridge of shale and some sandstone covered by a thin layer of clayey silt. The ridge acts like an extension of the dam adjacent to the reservoir.</p>	<p>The abutments appear to be stable with seepage at the toe of the fill as noted.</p>
ANY NOTICEABLE SEEPAGE	<p>There is considerable seepage along the downstream toe of the dam ranging from 0.5 g.p.m. to 3.0 g.p.m. as measured at four locations. Springs were reported by the owner from shale in the dam foundation during construction. There is stream flow collecting seepage along the toe. Some of the seepage is reddish-brown from iron precipitate.</p>	<p>Seepage profile through the dam needs to be defined.</p>
STAFF GAGE AND RECORDER	<p>There are none.</p>	

EMBANKMENT

Cove No. 2

VISUAL EXAMINATION OF		OBSERVATIONS	REMARKS OR RECOMMENDATIONS
DRAINS		Coarse shale was placed in the downstream toe to act as a drain. Clear seepage (0.5 to 3.0 g.p.m.) flows from the shale. Two French drains were reportedly constructed in a spring area in the lower part of the downstream portion with a polyethylene pipe for an outlet. A two inch plastic pipe was observed beside the 10 inch steel pipe near the center of the dam at the toe with one inch of flow.	The drains are functioning. The coarse shale appears to have partially disintegrated into smaller sizes.
FOUNDATION	1111-4	According to the Construction Memorandum, the foundation is shown to be jointed shale and red clay which has a steep dip downstream on the owner's cross sections. A cut-off trench is shown beneath the old upstream dam in red clay. The dam is on the northwestern flank of an anticline whose axis crosses Lake Leckzas approximately 250 feet east of the dam and parallel to it.	The red clay stratum is probably a weathered clay shale. There is apparently some sandstone interbedded with the hard shale. These descriptions were not verified by field observation.

Cove No. 2

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	There is no concrete in the dam.	
INTAKE STRUCTURE	Normal drainage flows through an 18 inch C.M.P. near the pool surface at the left abutment and down a rock slope in the ridge (see Photo 1). The inlet end of the pipe has been cut into a half-round.	The pipe is not blocked.
OUTLET STRUCTURE H H H H S	The 18 inch C.M.P. outlets into an indefinitely formed stilling basin in gray, fine-grained sandstone and shale on top of the ridge. The strata attain dips of 80° NW with a strike of N 40° E. There are steep joints.	
OUTLET CHANNEL	The water flows down the steep slope of the ridge on shale and sandstone to another stilling basin at the base where a stream channel starts.	
EMERGENCY GATE	There is none.	
LOWER OUTLET	A 10 inch Schedule 40 steel pipe had been placed through an old galvanized pipe at the base of the small dam and grouted for a seal. A shutoff valve was installed near the outlet at the downstream toe of the new dam. Water flow has been shut off.	

Cove No. 2

UNGATED SPILLWAY

VISUAL EXAMINATION OF		OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR		There is none.	
APPROACH CHANNEL		Compacted clay with shale fragments is at the beginning. Hard gray and brown shale with sandstone interbedded was observed in most of the channel. The strata dip 40° NW and strike N 40° E. Steep joints are prevalent.	The clay fill apparently has not been eroded significantly but needs additional rock protection against large overflows. No significant flow has been reported.
DISCHARGE CHANNEL		The outlet channel consists of mostly broken rocks with some soil deposits.	The width of the channel is narrow (see Photo 6); more rock would be beneficial to prevent erosion.
BRIDGE AND PIERS		There are none.	
FLOOD RELIEF		An emergency outlet is provided at the southwest end of the reservoir where a topographic saddle and a low compacted clayey silt and shale dike can channel flow during excessive rainfall. The overflow would be directed down a watercourse southwest to a pond. There is seepage at the toe of the fill.	This relief outlet may prevent overtopping of the dam. The water would eventually empty into Cove Lake below.

Cove No. 2

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	There are moderate slopes with some woods. A recreational area is located on the southwest portion of the reservoir where soil and shale borrow had been obtained. Erosion is minor and no sloughing was observed.	
SEDIMENTATION	The lake contains little silt.	

Cove No. 2

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF		OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)		There is considerable growth beside the channel. Several small streams from seepage merge to form one channel.	
SLOPES		Slopes are adequate to carry the normal flow.	
APPROXIMATE NO. OF HOMES AND POPULATION		There are no homes located between this lake and Cove Dam No. 1. Several campsite structures are located along the flood channel to the south- west of the dam.	

APPENDIX IV

CHECK LIST - ENGINEERING DATA

**CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION**

Cove No. 2

<u>ITEM</u>	<u>REMARKS</u>
PLAN OF DAM	No construction plans are available. The owner provided a written document on "Design Criteria and Operating Experience" which contains a sketched plan view of the lake.
REGIONAL VICINITY MAP	U.S.G.S. 7.5 minute quad sheet (Hayfield, VA) was used to prepare a vicinity map which is attached as the Location Plan.
CONSTRUCTION HISTORY	The owner supplied a Construction Memorandum presenting design criteria, construction information and operating experience. The dam was constructed over a small dam which was used as the upstream toe by the owner. It was completed in the spring of 1974.
TYPICAL SECTIONS OF DAM	Typical sections of the dam are enclosed in the Phase I Inspection Report in Appendix V.
HYDROLOGIC/HYDRAULIC DATA	None were available.
OUTLETS - PLAN	
- DETAILS	None were available, except as measured in the field.
- CONSTRAINTS	
- DISCHARGE RATINGS	
RAINFALL/RESERVOIR RECORDS	None were available.

Cove No. 2

ITEM	REMARKS
DESIGN REPORTS	Some design criteria is presented in the owner's Construction Memorandum. The reservoir is used as a recreational lake.
GEOLOGY REPORTS	The owner provided a geologic report with two lithologic cross sections showing the zones of the dam above the rock strata in the Construction Memorandum.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None were available.
HV-2 MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None were available.
POST-CONSTRUCTION SURVEYS OF DAM	None were available.
BORROW SOURCES	Soil and shale borrow was obtained from the southwestern area of the reservoir near the flood relief way.

Cove No. 2

ITEM	REMARKS
MONITORING SYSTEMS	There are none.
MODIFICATIONS	There are none.
HIGH POOL RECORDS	There are none.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None were available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	There are none.
MAINTENANCE OPERATION RECORDS	None were available.

Cove No. 2

ITEM	REMARKS
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SPILLWAY PLAN None were available.

SECTIONS

DETAILS

OPERATING EQUIPMENT None were available.
PLANS & DETAILS

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.6 square mile of wooded, undeveloped watershed

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1207.2 (149± acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1210.9 (225± acre-feet)

ELEVATION MAXIMUM DESIGN POOL: 1210.9

ELEVATION TOP DAM: 1210.9

CREST: Emergency Spillway 1 Emergency Spillway 2

a. Elevation	<u>1207.9</u>	<u>1209.2</u>
b. Type	<u>Earth side-channel, trapezoidal</u>	<u>Topographic saddle</u>
c. Width	<u>12 feet</u>	<u>400 feet</u>
d. Length	<u>50 feet</u>	<u>Not known</u>
e. Location Spillover	<u>Right abutment</u>	<u>Left of embankment</u>
f. Number and Type of Gates	<u>None</u>	<u>None</u>

OUTLET WORKS: Principal spillway

a. Type	<u>Owner constructed fixed crest weir and pipe</u>	
b. Location	<u>Left abutment</u>	
c. Entrance inverts	<u>1206.4</u>	
d. Exit inverts	<u>Unknown</u>	
e. Emergency draindown facilities	<u>Pipe and gate valve</u>	

HYDROMETEOROLOGICAL GAGES: None

a. Type	<u></u>
b. Location	<u></u>
c. Records	<u></u>

MAXIMUM NON-DAMAGING DISCHARGE Unknown

APPENDIX V

CONSTRUCTION MEMORANDUM

June 12, 1978

CONSTRUCTION MEMORANDUM

Design Criteria for Dam No. 2
at The Cove, Gore, Virginia
and Operating Experience

The lake established behind Dam No. 2 at The Cove, which is called Lake Leckszas, is designed as a fishing and recreational lake.

The dam was placed in order to gain maximum use of an existing small lake and dam structure and to take advantage of the well positioned, previously established dam structure which was well keyed and positioned to prevent seepage through the contemplated structure. The old existing dam was utilized as the water side (upstream) toe of the new structure.

The new dam was designed to increase the water depth from approximately 8'6" to the existing depth of 38' and to bring the water elevation to the maximum level compatible with the use of the ridge located to the southwest of the existing small lake, as a portion of the containment structure.

The design was planned to allow the southernmost portion of this ridge, which is comprised of several varieties of shale, to be overtopped, in the event of any massive flooding and to preclude the possibility of the dam structure ever being overtopped. The ridge, while somewhat permeable in nature, is relatively wide, and would not be subject to degrading due to overtopping; and, thus, it provides an excellent flood protection mechanism.

Due to the presence of a fairly permeable, but non-soluble, shale dike being present immediately behind the existing old dam structure, the new dam was planned as a three zone structure, with the upstream side being planned as the non-permeable portion of the structure. The additional two zones

are constructed of permeable shale, and serve as the bulk of the dam and also as drain material to preclude the possibility of hydrostatic pressure build-up in the body of the dam structure. Discharge of seepage through the non-permeable upstream side of the dam and the anticipated seepage emanating from the shale dike, which lies under the permeable (drain) portion of the new dam structure, is accommodated with this design.

Geological Factors which Dictated the Dam Design:

The dam is constructed on the westward side of a northsouth oriented anticline, with the axis of the anticline being located approximately 250 feet to the east of the dam structure. This anticline is principally composed of marine shales of varying density and hardness. Well to the east and west of the structure are located thick, nearly vertical seams of Oriskany sandstone, which form the outstanding geological features of the area. The axis of the anticline is well defined when investigated, and the fracture is evident along the axis with relative angular separation being approximately 90° at points 100 feet east and west of the axis and approaching 160° at points 250 feet east and west of the axis. This is the maximum, apparent angular separation throughout the entire structure in the area affected by the dam and impoundment. This disruption has lead to heavy shattering of the entire axial area, while the structure is less faulted as the distance increases from the axis.

The factor which makes the utilization of this site feasible is the presence of a strata of dense red clay, approximately 40 feet thick, immediately adjacent and upstream of the shale dike on which the main body of the dam structure is situated. The impervious portion of the dam (waterside zone) is keyed into the clay strata; and, thus, forms the non-permeable seal required to establish the dam structure.

Method of Construction:

The dam was constructed with the use of two pieces of equipment: one International TD18A bulldozer, and one LeTorneau ten yard, Model C, self-powered, scraper.

After the foundation area was cleared of all vegetation and unsuitable material, the drainline, a 10" Schedule 40 steel pipe, was placed through the original galvanized drain and grouted to seal to the old drain pipe. Note: this old pipe was found to be in good condition, and in fact, due to asphalt coating, was almost new in condition. The new drain pipe was

then extended to the toe (downstream end) of the new structure, and covered with compacted clay. Following this, the scraper was utilized to transport the clay and shale materials, and place them in their respective zones in approximate 10-inch lifts. Each lift was compacted with the loaded scraper, and then levelled and tracked down twice with the crawler tractor.

After the initial two lifts were established, two french drains were established on the north side of the dam drain to allow proper placement of additional lifts, without causing pumping action in the fill due to hauling of material. These drains were served by black polyethylene pipe, and commenced draining immediately. Flow was not measured, but has remained constant since 1973. Following this, the dam structure was raised in regular 10-inch lifts, with compacting being completed after the placement of each lift in all three zones. This process was carried out until the width of the dam brought the impervious front zone with a 20 foot thickness to a point where it intersected with the back drain zone with a thickness of ten feet, at which point the impervious zone was carried all the way across with no effort made to provide for downstream drainage above this point.

The dam was completed in the Spring of 1974, and has been full since this time.

Operating Results from the Structure Since Completion:

Since the initial filling of the new lake, the structure and impoundment have operated as designed. Within six weeks of the initial filling, the downstream toe of the dam indicated a water flow which reached its present rate in approximately 90 days from first appearance. This flow has remained constant for the past 3 years, and appears to present no adverse effect on the structure, or show any sign of increase. The dam structure is regularly inspected, and to date, has shown no change in elevation or profile.

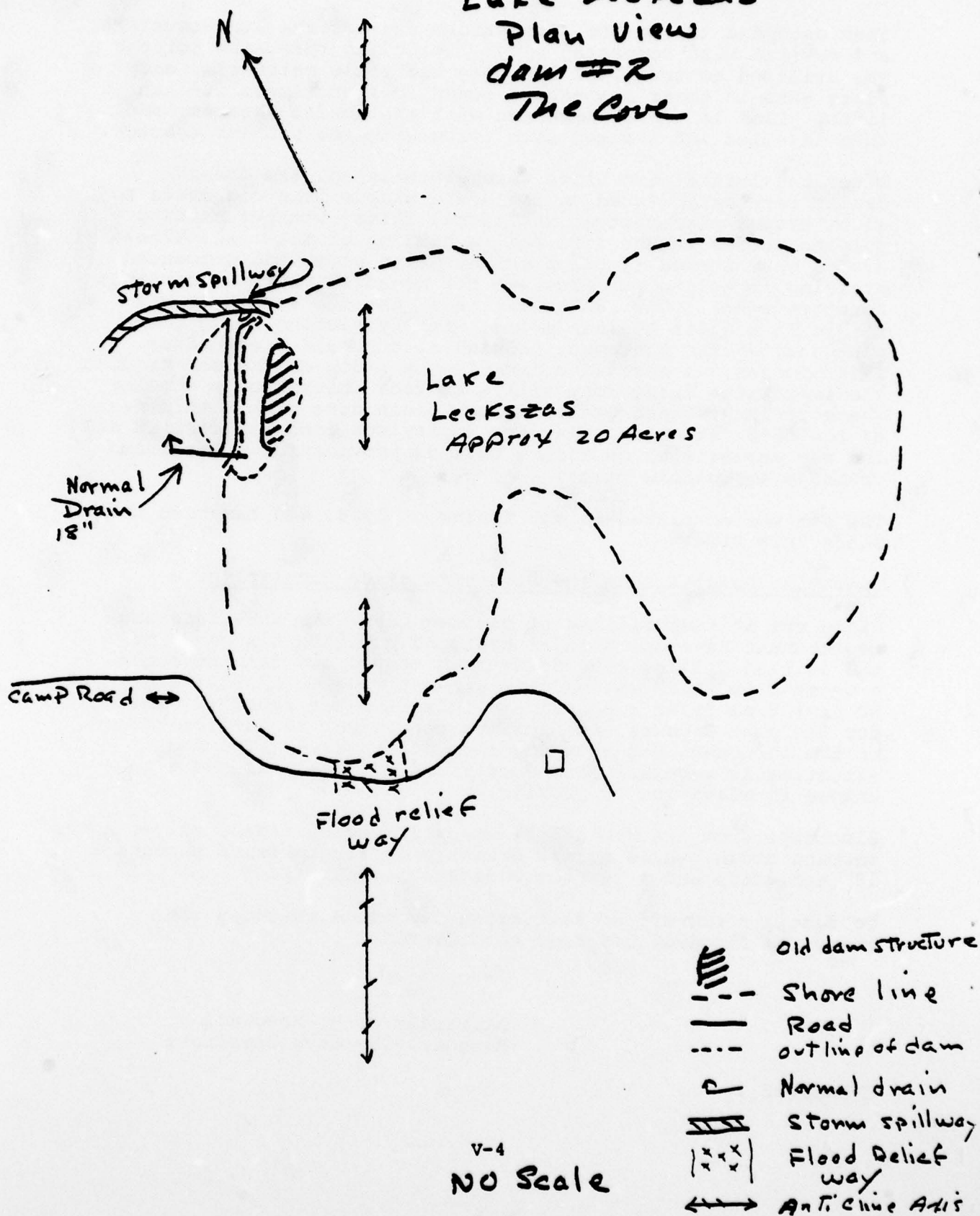
Discharge from the dam can be accomplished by a gate valve in the through drain, while normal drainage is accomplished through a 18" top drain and a 10 foot wide storm spillway.

To date, no run-off of sufficient magnitude to cross the emergency floodway has been encountered.









Alexander W. K. McDowell
Manager, The Cove Operators

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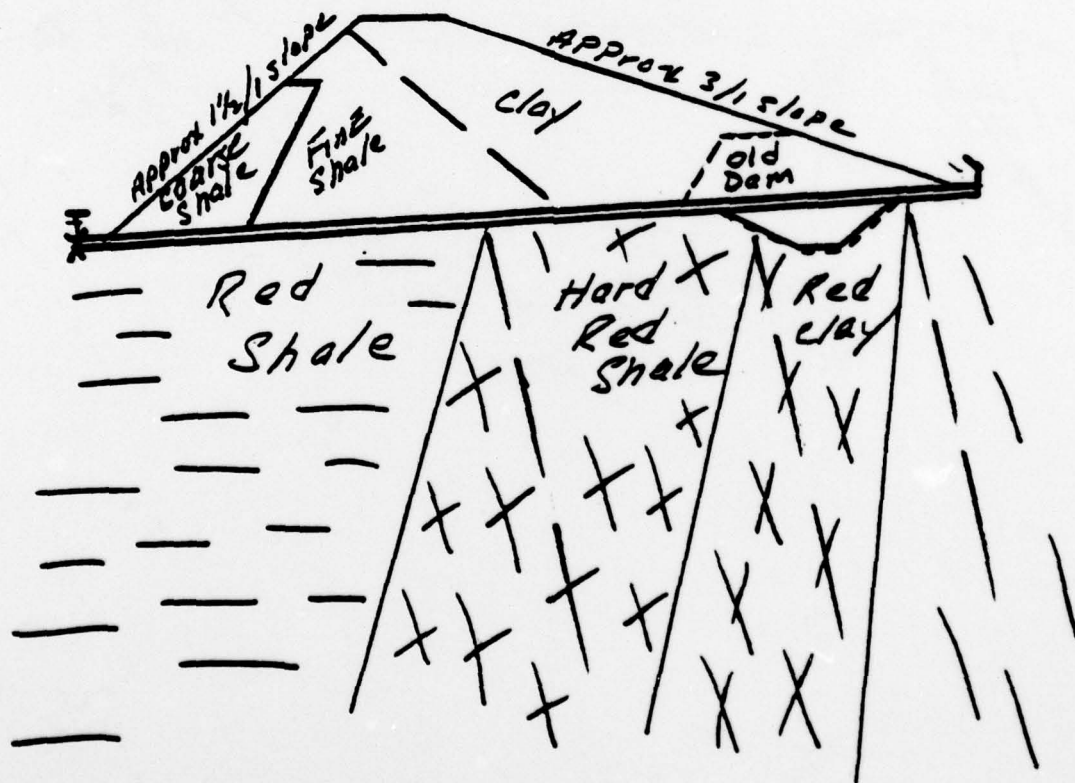
Lake Leckseas
Plan View
dam #2
The Cove



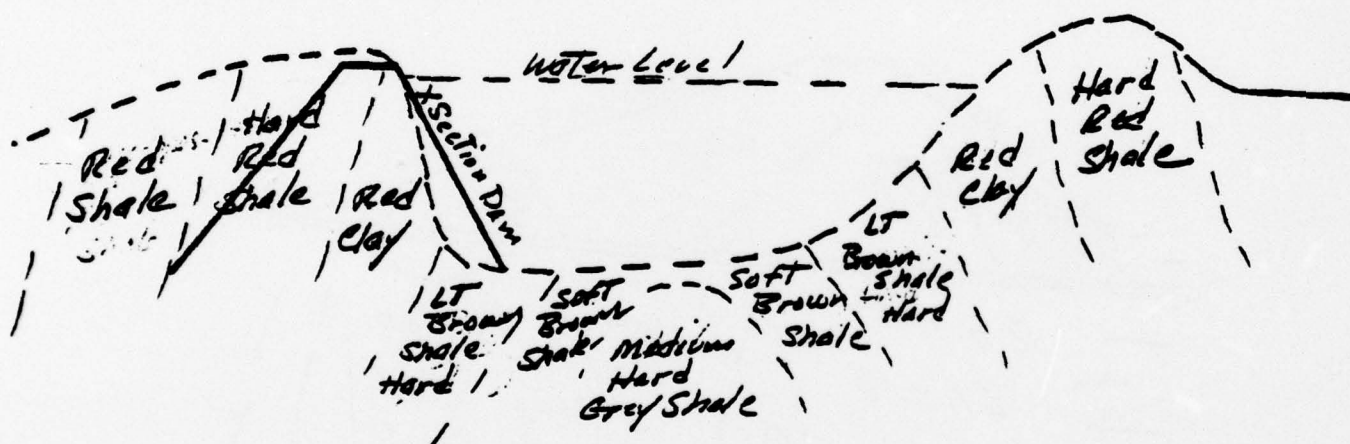
V-4
NO Scale

-  old dam structure
-  Shore line
-  Road
-  outline of dam
-  Normal drain
-  Storm spillway
-  Flood Relief way
-  Anticline Axis

Typical Cross Section
dam #2
The Cove



Typical Geological X Section



V-6 Note - no scale -